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## RTC on *Penaeus vannamei* aquaculture in Southeast Asia

The Regional Technical Consultation on the Aquaculture of *Penaeus vannamei* and Other Exotic Shrimp Species in Southeast Asia was held at Dusit Hotel Nikko, Makati City, Philippines on 1-2 March 2005. There were 58 participants—country representatives comprising the SEAFDEC National Coordinators and specialists in shrimp farming, AQD researchers and officials, and observers from the private sector and the media. AQD's Research Division Head Wilfredo Yap chaired the RTC.

*Penaeus vannamei* is native to the tropical Pacific coast of Central and South America. After it was domesticated in Hawaii and Florida, it became widely available for farming and it now makes up more than 95% of the shrimp production in the world.

The shrimp industry in Asia slumped in the 1990s due to widespread diseases that caused large losses to producers. Some shrimp growers stopped operations, some shifted to farming fishes, but many others shifted to *P. vannamei*. Relative to the native *Penaeus monodon*, *P. vannamei* has the following perceived advantages: lower feed cost, tolerance to higher stocking density, higher potential yield, commercially available specific pathogen-free seedstock and domesticated spawners. However, many Asian countries have legislation against the introduction and farming of exotic shrimp species such as *P. vannamei* for fear of new diseases that might be transmitted to wild shrimp populations through pond effluents.

During the RTC, the country representatives reported on the extent and status of aquaculture of *P. vannamei* and other exotic shrimps in Southeast Asia and China. Many were surprised at how much *P. vannamei* is now produced in

Thailand (about 300,000 metric tons) and China (605,000 mt, most of it in fresh water). Indonesia, Vietnam, Myanmar, and Cambodia are also farming *P. vannamei*; Malaysia and the Philippines are still considering importation.

The participants assessed the economic benefits of *P. vannamei* to the producing countries, and also the potential social and ecological impact of the introduction of *P. vannamei* in the region. No problems were identified in *P. vannamei* farming, but only in the procedures for import and the possible incidence of diseases. It was deemed necessary to monitor all farming of exotic shrimp species, whether or not the entry was in accordance with the law. It was also agreed that the ASEAN should develop its own capability to produce specific pathogen-free and specific pathogen-resistant stocks of *P. vannamei* and also of the indigenous tiger shrimp *P. monodon*.

### Proposed Plan of Action

1. Adopt the precautionary approach and formulate appropriate guidelines for the introduction and use of exotic shrimps.
2. Ascertain the extent of farming of exotic shrimps in each country. Determine and report actual production volumes of exotic shrimps.
3. Ascertain whether exotic shrimps have established themselves into the local ecosystem and study impact on populations of native species.
4. Support research for the establishment and maintenance of captive or farmed shrimp broodstock, including specific pathogen-free stocks.
5. Integrate strategies of aquatic animal health management into aquaculture development plans.



Country Representatives and SEAFDEC officials during the RTC on *Penaeus vannamei* aquaculture, Manila, 1-2 March 2005



### Seven finish regional training on KHV and TSV

The Regional Fish Diseases Project, funded by the Government of Japan Trust Fund, conducted a Hands-on Training on Detection of Koi Herpes Virus and Taura Syndrome Virus in Fish/Shrimp at SEAFDEC/AQD in Tigbauan on 7–12 March 2005. There were seven trainees – five sponsored by GOJ-TF (two from the Philippines and one each from Cambodia, Myanmar, and Vietnam) and two paying trainees from Vietnam. One of the trainees from the Philippines, Tomas Cuyos, had topped the distance-learning course AquaHealth Online in 2004. The hands-on training included lectures and practical laboratory sessions in cell culture and polymerase chain reaction assay for the detection of KHV and TSV. The resource persons were GL Po, LD de la Peña, Z Orosco, C Sombito, and M Paner of AQD's Fish Health Section.

Koi herpesvirus (KHV) is a major threat to koi and common carp production worldwide, including the wild populations. Discoloration and severe necrosis of the gills is the most consistent sign of disease. Epizootics of the disease involving fish of all ages have already been reported. KHV can be propagated in the KF-1 cell line and can be detected by PCR assay. Taura syndrome virus (TSV) is a highly virulent disease in *Penaeus vannamei* causing mortality as much as 95%. Gross signs of disease are reddening of the tail fan and visible necrosis of the epithelial tissues during the acute phase, and black lesions in the cuticle during the recovery or chronic phase.

### BFAR personnel train in virus detection by PCR

The Bureau of Fisheries and Aquatic Resources of the Department of Agriculture of the Philippines is currently conducting quarantine procedures on an imported stock of *Penaeus vannamei* and wants to closely monitor this stock and the subsequent progenies for diseases, particularly viruses. SEAFDEC/AQD was requested to train BFAR personnel at the Laboratory for Advanced Aquaculture Technologies, located at the AQD Tigbauan campus.



Thus, a special hands-on training on Detection of Shrimp Viruses by PCR was conducted on 15–19 March 2005. Five laboratory personnel from the National Integrated Fisheries Technology Development Center participated in the training. The AQD resource persons were LD Peña, M Paner, and C Sombito. One day of lectures was followed by four days of laboratory sessions on polymerase chain reaction assay, sampling methodologies, and preservation of tissues for PCR analysis. Trainees learned DNA and RNA extraction and master mix preparation, 1-step PCR, nested PCR, reverse transcription PCR, and gel electrophoresis, staining and analysis. Combinations of these methods are used in the diagnosis of shrimp viruses such as WSSV, IHHNV, and TSV.

### Dr. Tom: BFAR7's pride

Dr. Tomas Cuyos of the Bureau of Fisheries and Aquatic Resources in Region 7, Cebu City, topped the class in AquaHealth Online held from 2 August to 17 December 2004. Because of his good performance in the online course, Dr. Tom was invited to the recent Hands-on Training on Detection of Koi Herpes Virus and Taura Syndrome Virus in Fish/Shrimp on 7-12 March 2005 at SEAFDEC/AQD.

Dr. Tom is 28 years old, a Doctor of Veterinary Medicine from Southwestern University. He said that AquaHealth Online taught him a lot about aquatic animal health management and enhanced his skills and ability to perform his duties. In his college days, there was not a single subject in the curriculum of Veterinary Medicine that discussed about aquaculture and aquatic animal health management and medicine. The face-to-face training improved his ability to diagnose fish and shrimp diseases by means of cell culture and PCR assay.

Dr. Tom has worked with BFAR 7 for four years and is now directly involved in the national program for the responsible movement of live aquatic animals, including health certification to reduce the risk from the entry and spread of pathogens. He is also involved in on-farm residue monitoring and in upgrading the services and diagnostic capability of BFAR 7's Fish Health Laboratory.

*Dr. Tom is shown standing third from the right in the top photo on this page.*





## Fish Health scores three new books

The Regional Fish Diseases Program at SEAFDEC/AQD, under the leadership of Program Leader Dr. Kazuya Nagasawa, has published three more books. All three are available for free from SEAFDEC/AQD and will soon be uploaded in the AQD website for free download.

The *Laboratory Manual of Standardized Methods for Antimicrobial Sensitivity Tests for Bacteria Isolated from Aquatic Animals and Environment* is authored by L Ruangpan of the Chanthaburi Coastal Fisheries Research and Development Center in Thailand and EA Tendencia of SEAFDEC/AQD. Chapter 1 enumerates the steps to isolate bacteria from aquatic organisms by the streak plate method, and the different methods to store or preserve bacterial cultures. Also included in this chapter is the scheme used for the identification of bacteria to the genus level. Chapter 2 gives a step-by-step guide for testing bacterial susceptibility and resistance by means of the simple disk diffusion method. The zone diameter interpretative standard for veterinary pathogens is here given. Chapter 3 describes the method to determine therapeutic levels by the minimal inhibitory concentration test.

The book *Diseases of Cultured Groupers*, consists of six chapters (on bacterial, viral, fungal, parasitic, nutritional, environmental diseases in groupers), written by AQD scientists and edited by K Nagasawa and ER Cruz-Lacierda. The other book *Recent Advances in Diagnosis and Prevention of Fish and Shrimp Diseases in Southeast Asia* is a compilation of the research findings of the Regional Fish Diseases Project, edited by K Nagasawa.

AQD's Fish Health Team has been busy and we are proud of their accomplishments!

## Regional Fish Diseases Program reviews progress

The Regional Fish Diseases Program under the leadership of Dr. Kazuya Nagasawa, held its annual progress and planning meeting at Dusit Hotel Nikko in Makati, Philippines on 4 March 2005.

In attendance were the Project implementors: Supranee Chinabut, Somkiat Kanchankhan, and Suppalak Puttinaowarat from Thailand; Agus Sunarto and Tauhid from Indonesia; and EC Amar, CR Lavilla-Pitogo, GD Lio-Po, LD de la Peña, and EA Tendencia from SEAFDEC/AQD. Also present as Project evaluators were SEAFDEC Deputy Secretary-General and GOJ-Trust Fund Manager Junichiro Okamoto, newly appointed Trust Fund Co-Manager Dr. Koichi Okuzawa, and Japanese scientists Takaji Iida, Kazuhiro Nakajima, Ikunari Kiryu, Makoto Iwashita, Minoru Sorimachi, Yozo Kobayashi, and Nobuaki Okamoto.

Dr. Nagasawa summarized the accomplishments of the Project, including research, scientific conferences, training courses, and publications, particularly during Phase I. Dr. Okuzawa described the scope of the Project's activities during the current Phase II. The Project scientists presented the results of their research, the problems met, and their research plans for 2005. The meeting also discussed health certification issues, the need for expertise in parasite taxonomy, and the proposed Regional Meeting on the Standardization of Diagnostic Techniques for the Koi HerpesVirus. Deputy Secretary-General Okamoto offered logistic support in future aquaculture emergencies.

## Dr. Nagasawa says sayonara

After two years, two scientific conferences, and six books and manuals at the helm of the Regional Fish Diseases Program, Dr. Kazuya Nagasawa said goodbye to AQD on 22 March 2005.

At the despedida party for Dr. Nagasawa, the AQD Chief acknowledged his able leadership and thanked him for his contributions to AQD's achievements.

The Fish Health scientists, Dr. Gilda, Dr. Celia, Dr. Leobert, and Dr. Edgar, also attested to his leadership, how he drove them to accomplish their research and publish their results both in scientific journals and in books and manuals.

Dr. Nagasawa is a parasitologist by academic training and research experience. At AQD, he worked on fish parasites with Dr. ER Cruz-Lacierda, and sought the help of FishWorld in the identification of the fish hosts. He was even able to dissect a melon-headed whale that was brought to FishWorld and documented for the first time the parasites from that species.



## Learnings from Vietnam

A travel report by Celia R. Lavilla-Pitogo

I traveled to Vietnam on 3-9 April 2005 upon the invitation of the Director of the National Fisheries Quality Assurance and Veterinary Directorate (NAFIQAVED) to attend the Workshop on Developing a Strategy toward *Penaeus vannamei* Farming in Vietnam, held in Hanoi on 4-5 April 2005. My specific task at the workshop was to present the highlights of the recently concluded SEAFDEC Regional Technical Consultation on the Aquaculture of *Penaeus vannamei* and Other Exotic Shrimps in Southeast Asia, and to participate in the workshop sessions.

The Workshop was held at the Fortuna Hotel in Hanoi and was funded by SUMA, a DANIDA project based in Vietnam. Experts from Ecuador, Thailand, and China, as well as representatives from Malaysia and Indonesia reported on the status of *P. vannamei* farming in their respective countries. Experts also presented papers on the health status and on the social and economic aspects of exotic shrimp culture in Asia. About 100 participants from Vietnam's Ministry of Fisheries, NAFIQAVED, and the private sector attended the Workshop, which was conducted with simultaneous translation from English to Vietnamese and vice versa.

During the breaks, I had discussions with Dr. Flavio Corsin on surveillance strategies that he is doing in Vietnam using Level I diagnostic methods. Dr. Corsin, a Fish Health Specialist at the SUMA/NACA project in Vietnam, is an aquatic epidemiologist and has extensive experience in surveillance of aquatic animal diseases.

At the end of the Workshop, the National Aquatic Animal Health Committee was launched and inaugurated, and the 18 members were inducted. This Committee will oversee the aquatic animal health program of Vietnam.

The trip also allowed me to visit the Research Institutes for Aquaculture, RIA 1 in Hanoi and RIA 2 in Ho Chi Minh City. I visited RIA 1 on 6 April. With the guidance of Ms. Tran Kim Chi, I toured the main building's laboratories and the adjacent production facilities composed of a hatchery and several ponds for tilapia farming. Upon the invitation of Dr. Corsin, I sat in the meeting of NAFIQAVED to discuss implementation of GAP (good aquaculture practices) in the shrimp-growing provinces in Vietnam. The NAFIQAVED staff and representatives from the private sector discussed the value of testing for quality criteria, such as antibiotic residues in shrimp and aflatoxin in feeds, at different phases of production.



RIA 1 in Hanoi



The Histology Unit at RIA 2

I visited RIA 2 on 7-8 April. RIA 2 is a bustling and well-funded institute, with a new building now being constructed to house various laboratories and offices by June 2005. Dr. Ly Thi Thanh Loan, a Fish Health trainee at AQD in 1999 and now the Director of RIA2's Southern Monitoring Center for Aquaculture Environment and Epidemic gave a briefing about their activities in southern Vietnam and the Mekong Delta area.

Upon the request of RIA 2's Vice Director, I gave a seminar about the fish health project at SEAFDEC. I talked about diagnostic techniques, with emphasis on histology as a tool in disease identification. The seminar was attended by staff and students.

On my second day at RIA 2, I worked with the staff of the Histology Unit composed of 5 young people. The Histology Laboratory of RIA 2 is adequately equipped and can accommodate up to 500 samples a month. Based on the quality of slides that they showed to me, I reviewed their fixation techniques and advised them to revise it following recommended procedures by Bell and Lightner's Normal Histology Handbook. I also recommended that they use RNA-friendly fixative since the slides that they have processed using *in situ* hybridization probe for taura syndrome virus (TSV) did not give satisfactory results.

The GOJ Trust Fund Project that I am now currently implementing does not include Vietnam as a sampling site, but the discussion with staff in service laboratories will continue, and examination of diagnostic materials such as histological slides will be done to enhance technical capacity.

### Impresssions

1. The Vietnamese Government allocates a big sum to provide service to their aquaculture industry in terms of personnel and infrastructure.
2. Vietnam has installed measures to cope with the demand of the shrimp industry such as laboratory support for both health and quality assurance.
3. Adequate programs in disease monitoring and surveillance are already in place with funds from the national government and donor agencies.
4. The newly formed NAFIQAVED and newly launched their National Aquatic Animal Health Committee are concrete moves to support a sustainable aquaculture industry.
5. Although Vietnam now authorizes farming of *P. vannamei*, it is protective of its tiger shrimp *P. monodon* aquaculture industry.



## Handbook of Mangroves in the Philippines – Panay

A book review by Dr. Lawrence Liao

*The little-known world of Indo-Pacific mangroves has never been so wonderfully celebrated in such a compact field guide. This volume overflows with useful information as it describes and illustrates thirty-four species of mangroves, representing virtually the entire Philippine mangrove flora and about half of the world's known true mangrove species. Each species is depicted on easily readable opposing pages characterized by a refreshing layout of color photos, maps, icons and text that is pleasant to the eyes. Superb photography for each species includes shots of habitat, close-ups of leaves, flowers, fruits, and root systems which greatly facilitates field identification. Maps show sampling sites around Panay Island while graphical tidal range indicators plot the species' distribution in relation to the mean high water level at spring tide. Phenological time lines indicate flowering and fruiting periods for each species. Innovative icons provide quick information on plant form and root type, flower arrangement, inflorescence, leaf type and arrangement, shapes of leaf, its margin, apex and base. The text contains information on family, scientific and local names, morphological, ecological and ethnobotanical data.*

*While individual species descriptions take up the bulk of this handy field guide, the authors provide equally interesting and useful information on the economic importance of mangroves, citing historical and present usage. The current pattern of mangrove decline, so prevalent in Southeast Asia, is discussed with an emphasis on the Philippine situation. This decline is continuing, notwithstanding the plethora of local laws enacted for their protection. On the bright side, the authors argue for mangrove rehabilitation by providing narrative examples of successful mangrove conservation programs at the village level. The authors also draw from their extensive experience to support mangrove-friendly aquaculture practices as an alternative to the outright destructive conversion of mangroves into fishponds. The chapter closes with inspiring examples of community-based mangrove reforestation initiatives undertaken by government, academe, NGOs and people's organizations. A list of references is provided for those who want to obtain additional detailed information, while a glossary of technical terms is appended for consultation by laypersons.*

*This is definitely the best and most user-friendly mangrove field guide ever published in the Philippines. Compared to its predecessors, this book is comprehensive without the pitfalls of being overly technical. It is highly recommended for wide readership ranging from experts to the uninitiated. Here at long last is a book highlighting an important topic long denied to naturalist, legislators, politicians, community extension workers and the layperson. With the renewed, heightened awareness of the fragile nature and ecological importance of mangroves succinctly portrayed by the authors, mangroves in the Philippines stand to get a new lease on life. My only hope is that this valuable book reaches every audience that needs to hear its important message.*

## Dr. Koichi Okuzawa AQD Deputy Chief

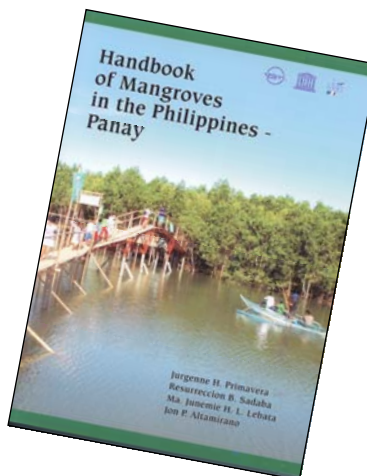


From the Fisheries Research Agency of Japan, particularly the National Research Institute of Aquaculture in Mie, Japan, Dr. Koichi Okuzawa joins the SEAFDEC Aquaculture Department as Deputy Chief and GOJ-Trust Fund Co-Manager, effective 1 March 2005.

Welcome to SEAFDEC and to AQD, Okuzawa-Sensei! Welcome to your wife Junko and daughters Mie and Hana!

Dr. Okuzawa earned his PhD in Fisheries in 1989 from the Department of Fisheries, Faculty of Agriculture, University of Tokyo, for his thesis "Endocrinological studies on the environmental influences upon the reproduction of honmoroko, *Gnathopogon caeruleus*." At the NRIA, he has conducted several research projects, including basic studies on the neuroendocrine mechanisms regulating reproduction in aquatic animals (1990-1998), development of sustained and ecologically low impact aquaculture and sea farming system (2001-2003), and assessment of the impact of global warming on agriculture, forestry and fisheries (2002-present). Dr. Okuzawa was Lecturer at Mie University and is currently Associate Professor at the Tokyo University of Marine Science and Technology.

On top of the administrative job as Deputy Chief, Dr. Okuzawa also serves as Program Leader of the Regional Fish Diseases Program, vice Dr. Kazuya Nagasawa. Dr. Okuzawa brings to AQD plenty of expertise in endocrinological research and technical experience in histology, biochemistry, radioimmunoassay, molecular biology and biotechnology, and marine fish breeding and rearing (— all the right stuff that AQD seeks in people to man the Laboratory for Advanced Aquaculture Technologies). He has also agreed to serve as lecturer in the AQD training courses, particularly in fish breeding and endocrinology.



*The handbook that launched a thousand praises — written by researchers from SEAFDEC/AQD and the University of the Philippines Visayas, and published with funding from UNESCO Jakarta*



## JIRCAS offers AQD study tours in Japan

The Japan International Research Center for Agricultural Sciences, based in Tsukuba City, collaborates with SEAFDEC on the project, *Studies on sustainable production systems of aquatic animals in brackish mangrove area*. JIRCAS Scientists Dr. Hiroshi Ogata and Dr. Ikunari Kiryu continue their research projects at AQD, one on the effect of essential fatty acids and vitamins on reproduction of marine fishes, and another on viral nervous necrosis in groupers.

Through JIRCAS Counterpart Researcher Invitation Program, AQD's Denny Chavez worked with Dr. Ogata in Tsukuba from 28 February to 31 March 2005 and determined the fatty acid composition of larval foods used in Philippine hatcheries.

Under JIRCAS' Administrators' Study Tour Program, AQD Chief Dr. Rolando Platon and Training and Information Head Dr. Teodora Bagarinao visited Japan from 13 to 20 March. Dr. Hiroshi Ogata was the gracious host throughout the study tour. First stop was JIRCAS Tsukuba, where Dr. Platon and Dr. Bagarinao met JIRCAS President Dr. Mutsuo Iwamoto, the Director for International Relations, and the Fisheries Division Director Dr. Koji Nakamura. Both sides expressed satisfaction with the results of the collaboration.

AQD also learned that the Japanese government seeks to develop a *Penaeus vannamei* farming industry to add to the low production of the indigenous kuruma shrimp *P. japonicus*. A new R&D project on *P. vannamei* is now being carried out by Dr. Marcy Wilder of JIRCAS in collaboration with the feed company Higashimaru and the International Mariculture Technology Company.

Mr. Setsuo Nohara and Mr. Takeshi Nomura offered a guided tour of the high-intensity indoor tank facility that is being developed by IMTC for *P. vannamei*.



A resting *P. vannamei* in Dr. Wilder's lab



AQD Chief RR Platon and TID Head TU Bagarinao with JIRCAS' Dr. Koji Nakamura and Dr. Hiroshi Ogata

From Tsukuba, Dr. Platon and Dr. Bagarinao visited the Tokyo University of Marine Science and Technology and met with Dr. Hiroshi Nakamura, the Director of the Technology Transfer Office. Dr. Nakamura holds 45 patents in his own name, all before he joined the university, and now he has set up mechanisms to assist professors, researchers, and technologists in getting patents for their products and inventions. After the official business, a visit was made to the National Science Museum—a wonderful place for learning.

Next was the flight to Kagoshima City to see the facilities of Higashimaru, the largest Japanese manufacturer of feeds for aquatic animals and terrestrial livestock (as well as processed food for people). Mr. Katsunobu Kuroki, General Manager of the Fisheries Research Department, briefed Dr. Platon and Dr. Bagarinao. Then he toured them around the nutrition and pathology laboratories and the impressive array of flow-through tanks containing many aquatic species at various life stages, on which a variety of feeds are tested.

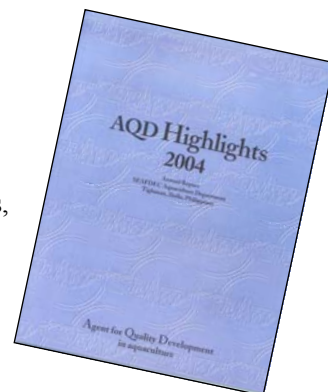


RR Platon with Dr. Ogata and Mr. Kuroki at Higashimaru, Kagoshima

## AQD Highlights 2004

Just off the press!!

A 44-page full-color account of SEAFDEC/AQD programs, accomplishments, and events during the most difficult year in its 31-year history







Ellen Flor and friends save the carcass of a beautiful leatherback caught in Parara Sur on 29 March

### A leatherback at FishWorld

SEAFDEC/AQD and DENR Region 6 inked a Memorandum of Agreement on 25 August 2004 for the former to provide tank facilities for the rehabilitation of stranded or sick endangered marine animals. Before then and since then, SEAFDEC FishWorld has been called on to care for marine turtles, neonate dugongs, dolphins, whales, and sharks.

On 29 March 2005 at 1 pm, a leatherback turtle *Dermochelys coriacea* was found entangled in a fishing net in Parara Sur, Tigbauan, Iloilo. The fishermen thought they had caught a large school of fish and were surprised to find a 'galangan' or leatherback, which unfortunately died soon after hauling. They reported the incidental capture of the leatherback to the Tigbauan Municipal Agriculture Officer, Phoebe Torico, who then reported it to Ellen Flor Doyola at FishWorld. The leatherback was a young adult about 200 kg in weight with curved carapace 128 cm long and 81 cm wide.

Parara Sur in Tigbauan, very near SEAFDEC/AQD, has been the site of several incidental captures of green turtles *Chelonia mydas* and olive ridleys *Lepidochelys olivacea*. And now the leatherback. The leatherback is one of the largest living reptiles, which can grow up to 900 kg, just feeding on jellyfish, tunicates, and other soft-bodied invertebrates. True to its name, the leatherback has a white-speckled black leathery carapace with five longitudinal ridges, instead of scutes or hard plates of horn-line material, as in most other species of turtles and tortoises.

In addition to preserving the carcass of the leatherback, FishWorld is currently caring for a diseased (warty) green turtle brought in by DENR, and for a long-captive hawksbill turtle *Eretmochelys imbricata* from a freshwater pond in Boracay, turned over by its sentimental 'owner.' Ellen Flor Doyola is the lady in charge of the rehabilitation of these turtles in the AQD tanks; she works closely with DENR veterinarians.



Participants in the UNESCO-MAB-SeaBRnet training at AQD Tigbauan, 18-29 April

### UNESCO-MAB-SeaBRnet training at AQD

SEAFDEC/AQD conducted the international training course on Responsible Aquaculture as a Component of Integrated Ecosystems Management on 18-29 April 2005 for 11 participants from Cambodia, China, Indonesia, Malaysia, Myanmar, Philippines, Thailand, and Vietnam. The training was done on behalf of the UNESCO Man and the Biosphere Reserves Program and the Southeast Asian Biosphere Reserves Network, with funding from the Government of Japan through UNESCO Jakarta. The trainees were MAB site managers or stakeholder representatives.

The training included lectures on the principles of responsible aquaculture, the wide variety of farming technologies that may be used in different environments, and importance of hatcheries, feeds, health management, post-harvest processing and markets, and socioeconomics. About half of the course was spent on field trips to aquafarms, fish markets, marine and freshwater ecosystems, and some 'protected' areas that are used for a variety of economic activities, including aquaculture. The Course Officer was Ruby Bombeo.

The opening ceremony at Tigbauan on 19 April was attended by AQD Chief RR Platon, Deputy Chief Koichi Okuzawa, other AQD officials, and trainers. The closing ceremony was held in Binangonan on 28 April and was attended by former AQD Chief AC Santiago Jr. and retired Scientist Dr. Corazon Santiago.

### BFS conducts more farmers' training modules

AQD's Binangonan Freshwater Station and the Aquaculture-Based Countryside Development Enterprises Foundation Inc. continue to assist Municipal Agricultural Officers and other local government officials in implementing aquaculture-based livelihood activities. The BFS-ABCDEF training team conducts on-site training for fish farmers who will be involved in the fishfarming clusters.

This year, thus far, six training sessions on Integrated FishFarming and Freshwater Aquaculture have been completed: in Siniloan, Laguna on 27-28 January; in Jalajala, Rizal on 31 January – 1 February; in Sta. Cruz, Laguna on 10-11 February; in Angono, Rizal on 24-25 February; in Morong, Rizal on 31 March -1 April; and in Cabuyao, Laguna on 26-27 April. A total of 241 farmers and 55 local government representatives had attended the six Farmers' Training Modules this year.

A follow-up hands-on training-seminar is planned for municipal agricultural technicians to help them acquire the knowledge and skills to become trainers themselves so they can teach their farmer constituents the basic aquaculture technologies.



## Bangus Goes Global: 2nd Bangus Congress, Dagupan City, 28-29 April 2005



The Bangus Congress focuses on industry needs, issues, problems, and solutions. Dagupan holds the Congress as part of its annual fiesta celebration.



### PHILIPPINE BANGUS DEVELOPMENT PROGRAM

The Philippine Bangus Development Program is a government intervention towards self sufficiency of fry in the country through the establishment of satellite hatcheries

#### OBJECTIVES

1. To sustain the requirements for milkfish fry of fish farmers in the Philippines.
2. To discourage the importation of milkfish fry from other countries like Indonesia and Taiwan.
3. To produce cheap supply of quality milkfish fry in strategic locations in the country.
4. To generate livelihood opportunities from milkfish breeding, fry production and marketing for Filipinos living in coastal areas.

#### MILKFISH FLOW DIAGRAM

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graph LR
    A[Control Hatchery - CARI] --> B[RYE]
    A --> C[RYE]
    A --> D[RYE]
    B --> E[Fingerling Production]
    C --> E
    D --> E
    E --> F[Milkfish Pond Growers]
    F --> G[Bangus Cage Growers]
  
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#### PROGRAM STRATEGIES

1. Expansion of breeding and hatchery facilities
2. Development of fry production and marketing
3. Development of fry production and marketing
4. Development of fry production and marketing

#### EXPECTED IMPACTS

1. Self-sufficiency of supply of quality milkfish fry through the initial production of 200M fry.
2. Generate potential savings of about US \$12M from fry importation.
3. Generate 625 livelihood opportunities for Filipinos living in coastal areas.
4. Increase production of marketable-size milkfish fry by 20M tons equivalent to PHP 1,500.
5. Reduce loss from aquaculture (due to fry) and related problems 90% due to regular environmental monitoring, education and culture programs.

